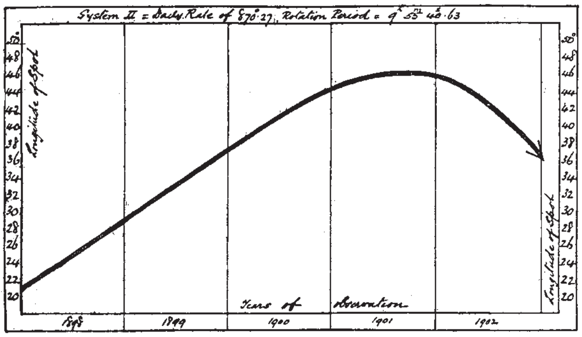
The table shows that the "very good" and "good" nights, taken together, included little more than one-fourth of the aggregate number of observations during which the state of definition was recorded.

Though frequently marred by bad atmospheric conditions, a number of very interesting formations were visible on the planet in 1902. Perhaps the most noteworthy feature of the opposition was the very marked acceleration which occurred in the rate of motion of the great red spot. The longitude of this marking in April, 1902, was 46°, but early in January, 1903, it had declined to 37°, and the resulting mean rotation period during about eight months was 9h. 55m. 39s., or 3 seconds less than the period in 1899, when it was nearly 9h. 55m. 42s. The following diagram will exhibit the changes in the longitude of the spot during the last five years:—



The equatorial region of Jupiter was very brilliant during the past opposition, and the interval separating the dark belts on either side of it seemed filled with glowing material. The usual dark and white spots were distributed along the north side of the south equatorial belt, and the mean rotation period of these was found to be 9h. 50m. 26s. ·7, or about 2½ seconds less than last year. The observations indicate that this equatorial current became rather suddenly accelerated towards the close of the opposition. It will therefore be rather important to determine its rate as early as possible in the ensuing spring, when Jupiter reappears in the morning sky. It will also be interesting to observe the position of the red spot in order to find whether the recent marked increase in its motion has been maintained.

W. F. DENNING.

SOCIETY FOR PSYCHICAL RESEARCH.

SIR OLIVER LODGE, in the course of his address before the Society for Psychical Research on Friday last, said that a few friends who desired to remain anonymous had started an endowment fund, amounting at present to 2000*l.*, in order to set the Society upon a sound and permanent basis, and in order to provide the material means of attacking the problems which the future might bring before them. As soon as a capital sum of 8000*l.* had been attained, it was proposed to offer a research scholarship in psychical science, to which a holder, irrespective of sex or nationality, might be appointed for one year and from year to year as might seem good, his or her time to be devoted to the work of psychical investigation. When practical benefits could be definitely foreseen, people felt justified in spending money even on science, though as a rule that and education were things on which they were specially economical.

And why should not psychical investigation lead to practical results? Were we satisfied with our treatment of criminals? Were we, as civilised people, content to grow a perennial class of habitual criminals and to keep them in check only by methods appropriate to savages—hunting them, flogging them, locking them up and exterminating them? Any savage race in the history of the world could do as much as that, and if they knew no better, they were bound to do it for their own protection. Society could not let its malefactors run wild any more than it could release its lunatics. Until it understood these things, it must lock them up; but the sooner it understood them the better. Force was no remedy; intelligent treatment was. Who could doubt but that a study of obscure mental facts would lead to a theory of the habitual criminal, to the tracing of his malady as surely as malaria had been traced to the mosquito? And, once we understood the evil, the remedy would follow. It was unwise and unscientific to leave prisoners merely to the discipline of warders and to the preaching of chaplains. That was not the way to attack a disease of the body politic. He had no full-blown treatment to suggest, but he foresaw that there would be one in the future. Society would not be content always to go on with these methods of barbarism; the resources of civilisation were not really exhausted, though for centuries they had appeared to be. The thing demanded careful study on the psychical side, and it would be a direct outcome of one aspect of their researches. The influence of the unconscious or subliminal self, the power of suggestion, the influence of one mind over another—these were not academic or scientific facts alone; they had a deep practical bearing, and sooner or later it must be put to the proof.

They sought to unravel the nature and hidden powers of man; and a fuller understanding of the attributes of humanity could not but have some influence on our theory of divinity itself. If any scientific society was worthy of encouragement and support, it should surely be that. If there was any object worthy the patient attention of humanity, it was surely these great and pressing problems of whence, what and whither that had occupied the attention of prophet and philosopher since time was. The discovery of a new star, or a marking in Mars, or of a new element, or a new extinct animal or plant was interesting. Surely the discovery of a new human faculty was interesting too? Already the discovery of telepathy constituted the first fruits of that society's work, and it had laid open the way to the discovery of much more. Their aim was nothing less than the investigation and better comprehension of human faculty, human personality and human destiny.

THE MEXICAN AXOLOTL.

WHEN I was in Mexico during the last summer, I naturally paid attention to the Axolotl question, a problem which in spite of, or perhaps because of, the various articles written on this subject has remained in a state of confusion. I am now able to make statements which will afford a solution.

In the normal course of events, Amblystoma spawns in the water and the larvæ metamorphose into the entirely lung-breathing, terrestrial creature which alone is sexually ripe.

A. tigrinum, the image of the Axolotl, has a wide distribution, ranging from New York to Colorado and to the valley of Mexico. Velasco[1] received metamorphosing larvæ of the typical *A. tigrinum* from the little lake Santa Isabel, near Guadeloupe, about five miles north of the capital. There is no reasonable doubt that this species occurs in the perfect form in various other parts of the valley of Mexico, for instance, around Lake Zumpango. A sure sign of the approaching metamorphosis is the appearance of large yellow, irregular patches on the surface, which is at first uniformly dark. By some individuals, this adult coloration is assumed early, when the larvæ are less than half grown; in others it is delayed.

There are various places in Mexico and in the United States where not all the larvæ metamorphose. Some remain more or less uniformly dark, retain their gills and fins, but become sexually ripe. Such typical Axolotl occur side by side with metamorphosing and with metamorposed specimens. Examples:—The Natural History Museum at South Kensington possesses a gravid female, a big typical Axolotl from Anclan, Jalisco; from the same locality are four half-grown larvæ which have assumed the tiger spots, a sure sign of approaching metamorphosis. There are further, from St. Mary's Lake, Estes Park, Colorado, 7400 feet altitude, two full-grown perennibranchiate males in breeding condition and one big female. Lastly, from the Cumbre de los Arrastrados, Jalisco, 8500 feet, there are several young larvæ of the unmistakable spotted type, and one large male larva which is dark and spotless and with all the appearance of not going to change.

In a few favoured localities, none of the larvæ change into the complete Amblystoma, but propagate as permanent Axolotl. This applies to that clan of *Amblystoma tigrinum* which inhabits some of the lakes near Mexico City. It is well known that the offspring of these specimens can easily be induced to metamorphose, witness the European stock of Axolotl and Amblystoma, which all have descended from the classical specimens in the Jardin des Plantes.

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[1] *La Naturaleza*, vol. iv. (1879), pp. 209–233, pls. vii.–ix.; *cf.* also Spengel, who gives a much condensed *résumé* with remarks upon Velasco's paper, *Biolog. Centralblatt*, vol. ii. (1882), pp. 80–83.

Velasco's important announcement that regularly metamorphosing Amblystoma occur near the city of Mexico has become complicated by a more recent discovery. The numerous streams of the well-wooded mountain slopes which border the valley of Mexico to the west and south are inhabited by *A. altamirani*, a species very distinct from *A. tigrinum*. This *A. altamirani* metamorphoses regularly. It was described by Dugès.[1] Specimens seem to be very rare in collections, perhaps because nobody has taken the trouble of collecting any since Dugès. The types were found about fifteen miles to the west of the city, at an altitude of about 8800 feet, in the Montes de las Cruzes. On June 18, we went by the Mexican National Railway to the station Dos Rios, 8800 feet above sea-level, and fished out of the streams several dozen spotted larvæ of some three inches in length and several adult males and females in perfect Amblystoma condition. Towards the end of September, we again took some specimens from the same streams. The larvæ averaged perhaps half an inch more in length, otherwise there was no change visible. The adult Amblystomes were still in the water, one of them a beautiful, yellowish albino. On September 28, we went by the Cuernavaca Railway to the station of Contreras, altitude 8090 feet and in a bee-line about twelve miles south-south-west from the city. Following up various streams, we again found the newts, larvæ and adult, at an altitude from 8500 feet upwards to 8800 feet; further up, the rivulets were apparently too small. The creatures lived in the cool, rushing stream, preferring the sheltered side of large boulders, the larvæ working their gills vigorously, the adult motionless and never coming to the surface; all extremely shy and very quick. One of the specimens was full of nearly ripe eggs.

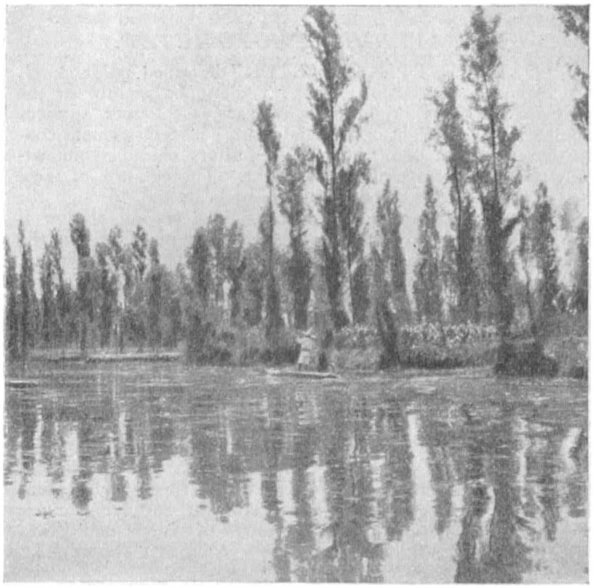

Fig. 1.—Chinampas or "floating" gardens of Lake Xochimilco, June, 1902.

Searching in the streams only a little above the city, which lies at an altitude of about 7600 feet, was fruitless.

To return to *the* Axolotl, the permanent and sexually ripe larva of *A. tigrinum*. This is restricted to the Lakes Chalco and Xochimilco, to the south and south-east of the capital. No larval or adult specimens of any kind of newt occur in the Lago de Texcoco, the largest of the lakes. Its water is too brackish, and it was already quite undrinkable at the time of the conquest, when this lake extended to and surrounded the city. Its present mean level is six to seven feet below the zero of the town, from which it is about three miles distant. This lake is now silting up fast, since the marvellous drainage canal not only intercepts the dangerous spates of the western streams, but also drains the lake whenever its level rises a few feet. However such a low rise suffices for the lake to extend over many square miles of the neighbourhood, which during the dry period is covered with a white saline crust, interspersed with scanty grass, on which cattle and horses eke out a precarious existence. The lake is not quite dead; it contains several kinds of fish, only one of commercial value, and numerous waterfowl visit it in the late autumn.

Lakes Chalco and Xochimilco are a paradise, situated abou ten feet higher than the Texcoco Lake and separated from it by several hills. High mountains slope down to the southern shores, with a belt of fertile pastures, with shrubs and trees and little streams, here and there with rocks and ravines. In fact, there are thousands of inviting opportunities for newts to leave the lake if they wanted to do so. Close to the southern end of Lake Xochimilco, absolutely clear water wells up from the bottom, forming the famous *ojos de agua* or springs, which are thirty to forty and more feet in depth. Much of the lake, perhaps half of its surface, is filled with the celebrated *chinampas* or "floating gardens," *i.e.* many hundreds of islands surrounded by ever so many wide and narrow canals, here and there with a large stretch of water. Young little islands are still in process of formation, floating masses of entangled peat, rushes, moss and grass. Such floating clumps are caught, combined and anchored by stakes or long saplings of willows and poplars, which are driven into the muddy ground, where they soon take root. The fertile mud is ladled up from the bottom, heaped upon the float, which thereby is converted into an island proper, until a garden is produced in which are cultivated masses of all kinds of flowers, melons, pumpkins, gourds and all other produce, which is taken daily to the market through the Viga Canal right into the city. The larger islands are mostly surrounded by tall poplars, planted in rows along the edges, thus forming a firm boundary. Undue shade is prevented by lopping off the side branches. None of the islands is higher than a foot or two; some are now firm enough to support houses. The depth of the water averages perhaps five to ten feet, shallower towards the north-west, where the lake gradually changes into a swamp of rushes. The further away from the powerful springs, the muddier and darker appears the water, full of suspended fresh and decomposing vegetable matter, teeming with fish, larvæ of insects, Daphniæ, worms and Axolotl. These breed at the beginning of February. The native fishermen who punted us about in dug-outs through this paradise knew all about them; how the clusters of eggs were fastened to the water plants, how soon after the little larvæ swarmed about in thousands, how fast they grew, always remaining dark and never piebald or marbled with yellow, until by the month of June they were all grown into big, fat creatures ready for the market. Indeed, we could not get any small specimens in the month of June, when we paid our first visit. Later in the summer they take to the rushes, in the autumn they become scarce.

None has ever been known to leave the water or to metamorphose, in spite of Valasco's hearsay statement. But *axolotes sin aletas* (*i.e.* without winglets, meaning gills) are called *axolotes del cerro* (mountain-axolotl), or *axolotes sordos* (deaf, having no ears). However, none of these, many of which are undoubtedly *A. altamirani*, are found in the vicinity of the two lakes.

The reason why there are only perennibranchiate, permanent Axolotl in the lakes of Chalco and Xochimilco is obvious. The constant abundance of food, stable amount of water, innumerable hiding places in the mud, under the banks, amongst the reeds and roots, all these points are inducements or attractions so great that the creatures remain in their paradise and consequently retain all those larval features which are not directly connected with sexual maturity. There is nothing whatever to prevent them from leaving these lakes, but there is also nothing to induce them to do so. The same applies occasionally to European newts, of most of which we now know instances of sexually ripe "larvæ." Nevertheless, in the case of our Axolotls the latent tendency to metamorphose can still be revived. When once sexually ripe, the Axolotl are apparently incapable of changing, but that their ancestral *régime* is still latent in them, not quite forgotten, is shown by the metamorphosing offspring of Axolotl bred in Europe.

My explanation suggested itself during our visits to these lakes, which in every respect are so totally different from any other lakes, pools and rivers we have seen in that wonderful country. The only objection is that nobody has thought of this explanation before, but I do not know of any zoologist who has studied the question on the spot, except de Saussure,[1] who was there some thirty years ago. He suggested that the swamps which extend between the water and the dry land prevented the creatures from gaining the latter and therefore from transforming. But thick rush-swamps fill only the north-western extent of the region. Then Weismann speculated upon the dismal condition of the salt-incrusted surroundings which were supposed to have hemmed in the Axolotl. This dream could apply only to Lake Texcoco, where there are none! The latest suggestion has been made by Herrera,[2] the professor of zoology in Mexico. He puts it categorically that the Axolotl cannot transform for want of food. Fancy the idea that overcrowding of the lakes, which are teeming with food, causes famine and at the same time produces big, oily, fat Axolotl!

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[1] *La Naturaleza*, 2nd ser., vol. ii. (1896), p. 459.

The inducements to remain in the water, their birthplace, have become too strong for the larvæ to yield to their innate tendency of further development. Nothing is stunted in their bodies. On the contrary, they become to a certain extent overgrown, and the sexual organs, which anyhow in most terrestrial Urodela are active only during the temporary aquatic life, undergo their normal course of development and function. H. GADOW.

ISOMERIC CHANGE IN BENZENE DERIVATIVES.[3]

IN recent years, it has become realised that in many chemical reactions, isomeric changes—that is, the change of a given substance into another of identical composition, but possessing a different and under the conditions a more stable constitution—play an important part; thus, as is well known, from the salts of certain organic acids, the acid frequently cannot be obtained, but a neutral isomeride (the pseudo-acid) into which the acid changes is alone isolated. One very interesting instance of isomeric change is to be found in the process of substitution in certain benzene derivatives. As long ago as 1887, Armstrong suggested that the ready production of para-derivatives from amino- and hydroxy-aromatic compounds—anilines and phenols—was due to the formation initially of isomeric compounds in which the amino- or hydroxylic hydrogen was displaced by the substituting group. Since that date, these labile precursors (phenyl chloramines, nitramines, &c.) of the ordinary substitution products (chloro-, nitro-anilines, &c.) have been isolated in numerous cases. They can always be transformed into the stable isomeride, but this change seems to be conditioned by the presence of some other substance—the catalyst. As Armstrong has suggested, these isomeric changes are "fermentative" in character, often taking place with great facility and under the influence of minute amounts of the catalyst. Measurements of the velocity show that changes of this type are always apparently monomolecular (that is, each molecule changes *per se*); but such a result only proves that the slowest reaction is monomolecular and does not exclude the possibility of the simultaneous occurrence of other more rapid transformations, which form part of the complete change.

A most instructive example of isomeric change is found amongst diazobenzene derivatives. The diazobenzene salts are derived from the base, diazonium hydroxide, to which is now generally assigned the expression $Ph.N(OH)\equiv N$. On treatment with alkalis, this base is converted into the salts (diazotates) of an isomeric acid, to which the formula $Ph.N:N.OH$ is given. On attempting to isolate the acid from these salts, a neutral isomeric substance (the pseudo-acid) is obtained; this is probably a phenylnitrosamine, $Ph.NH.NO$. In this paper, the author describes a new case of intramolecular change of a remarkably interesting kind:—Chloro- and bromo-benzenediazonium hydroxides, $C_6H_2X_3.N(OH)\equiv N$, readily change into isomeric hydroxybenzene derivatives, $C_6H_2X_2(OH).NX\equiv N$, the hydroxyl group and one of the halogen atoms (an ortho-placed halogen atom) having exchanged positions. This change not only affords another illustration of the transference of a group from the side chain of an aromatic compound into the benzene nucleus, but further shows the tendency, which has been occasionally noticed, for an ammonium base to change into an isomeric substance of neutral character. Under all conditions, when it is possible for the diazonium hydroxide to be present, the wandering of the hydroxyl group takes place. Thus in dilute aqueous solution of such diazonium salts as the nitrate or the hydrogen sulphate, the small quantity of diazonium hydroxide which arises from hydrolytic dissociation undergoes this change. In the presence of excess of acid, there is no hydrolytic dissociation and consequently the isomeric change does not take place. In the case of the salt of a weak acid, as the acetate, where the hydrolytic dissociation is considerable, the rate of interchange of halogen for hydroxyl is greatly increased. In the naphthalene series, this intramolecular change occurs with even greater ease and rapidity than in the benzene series.

The elucidation of the nature of the process by which halogen is eliminated from diazobenzene compounds (a reaction first observed by Meldola in the naphthalene series) has rendered possible the removal of certain errors in the statements regarding the changes undergone by diazonium compounds. Thus Hantzsch has recently stated that *s*-tribromobenzenediazonium hydroxide, $C_6H_2Br_3.N(OH)\equiv N$, changes into the corresponding phenyl nitrosamine, $C_6H_2Br_3.NH.NO$, not realising that under the conditions (presence of acetic acid) an isomeric change has taken place, bromine being eliminated.

A DAYLIGHT PHOTOMETER.

A "DAYLIGHT PHOTOMETER" described by Mr. A. H. Munsell, of Boston, Mass., is designed mainly for the comparison of the brightnesses of various coloured surfaces illuminated by daylight or artificial light. The instrument consists essentially of two "cat's-eye" shutters placed symmetrically towards a source of diffused light. Through one of these the light falls on the coloured surface to be tested, through the other upon a standard white surface. The second shutter is then gradually closed until the resulting grey produced on the white screen just matches the coloured surface in intensity, whilst a dial connected with this shutter shows, in percentage, how much darkening has been necessary to match the coloured surface under test. The instrument has also been applied to the testing of light transmitted through coloured media. Owing to the wide variation in the sources of light used, as well as in the colour perceptions of different observers, no degree of absoluteness can be attached to the readings. As Purkinje and Dove showed, the relative brightness of two differently coloured surfaces changes as the strength of the illuminating source is altered. But although the readings of the instrument must for these reasons be interpreted with great caution, the arrangement seems capable of supplying much interesting information on the variations of colour perception under different conditions. ALBERT CAMPBELL.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—It was agreed by the senate on January 29, by a large number of *placets* to one *non-placet*, to appoint two additional demonstrators of human anatomy.

The funeral service for the late Master of Caius, Dr. N. M. Ferrers, F.R.S., took place privately in the college chapel yesterday, February 4. The public service for the late Sir G. G. Stokes, F.R.S., Master of Pembroke, is to be held in St. Mary's Church to-day, and will be attended by a large number of members and officers of the University and representatives of learned societies.

By the will of the late Mr. F. J. Quick, of Trinity Hall, the residue of his estate, valued at some 50,000*l.*, is placed in trust for the promotion of study and research in vegetable and animal biology. The University is to draw up a scheme for the administration of the trust, wherein it shall be provided that no office or appointment paid from the income of the fund shall be held by the same person for more than three years without being thrown open for a fresh election.

The election to the Lucasian professorship, vacant by the death of Sir G. G. Stokes, will take place at noon on February 28. The electors are the heads of colleges.

Miss I. Sollas, Newnham College, has been nominated to

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[1] *Verhandl. Schweizer naturforsch. Gesellsch. Einsiedeln* (1868), p. 89.

[2] *La Naturaleza.* 2nd ser., vol. iii. (May, 1900).

[3] Abstract of paper on "Isomeric Change in Benzene Derivatives—The Interchange of Halogen and Hydroxyl in Benzenediazonium Hydroxides." By Dr. K. J. P. Orton. Read before the Royal Society December 4, 1902.